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## CONCRETE CERAMIC BRICK

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The composition of a stiff molding mixture has been developed for making concrete ceramic solid brick by press molding or vibrocompression. The brick has a standard size, beige or light red color, and meets the requirements of GOST 530–95. The production cost of this brick is 30 – 35% lower than that of analogous ceramic bricks because the firing operation is excluded from the production cycle.

The name "concrete ceramic brick" is given to a nonfired wall material having the form of a solid brick of dimensions 250 × 120 × 65 mm with beige or light red color, which was developed at Tula State University. The term "concrete" arises from the sand-cement component that is part of a stiff molding mixture and from a production technology similar to the production technology of slag concrete blocks. The term "ceramic" is due to the fact that the molding mixture contains over 50% fillers in the form of crushed waste of coarse ceramics (brick, roof tiles, drain pipes with or without claydite waste additions), as well as the process of joint drying of plastically molded ceramic articles with molded concrete ceramic bricks. The drying duration should be at least 72 h, adhering to the drying regime for ceramic bricks but with higher relative moisture in the first two days to ensure the reaction of hydration of clinker minerals contained in Portland cement.

After drying, including thermal moisture treatment, the concrete ceramic brick acquires at least 75% of its rated strength, and what is important, after 28 days (including 3 days of drying) its properties meet the requirements of GOST 530–095. The production cost of concrete ceramic brick is 35 – 40% lower than that of analogous ceramic brick, provided that the former is produced at coarse ceramics factories, since in this case the fuel and energy costs and freight expenses for the delivery of over 50% fillers are excluded, due to the utilization of fired ceramic waste.

Concrete ceramic brick is molded from stiff mixtures by vibrocompression or press molding. The beige color in bricks is provided by a combined additive including two or sometimes three environmentally safe pigments, the first two being "know-how" compounds, and the third is finely crushed ceramic brick with specific surface area 3000 – 3500 $cm^2/g$. The latter also acts as an active mineral additive increasing the corrosion resistance of the brick.

A standard-sized concrete ceramic brick has the same weight as a solid ceramic brick (3.2 – 3.8 kg) and strength parameters corresponding to grades M75, M100, and M125. The resistance to cold of this brick is at least 25 cycles, and the thermal conductivity is 0.65 – 0.70 W/(m · °C). The bending strength of the concrete ceramic brick is 1.5 – 2 times higher than that of the standard ceramic brick. Its surface has a homogenous color (beige or light red) without salting out and cracks. This brick can be used for exterior facing.

A concrete ceramic brick of similar physicomechanical properties but inferior decorative parameters is manufactured in Smolensk Region (Safonovo, brick factory No. 2). It is marketed at the same price as ceramic bricks. The brick made at that factory was taken by us as a prototype with the aim of improving its decorative quality. It should be noted that good decorative qualities were obtained by selecting a specific weight composition of the mixture components and a specific ratio of the coarse and fine fillers, as well as certain parameters of the physicochemical process which takes place in heat treatment (drying) of the concrete ceramic brick.

With respect to the known analogs represented by concrete slag blocks with equal strength parameters and resistance to cold, the concrete ceramic brick has lower average density (by 15 – 25%) and better decorative outlook for equal consumption of Portland cement per 1 $m^3$ of mixture.

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Thus, a new composite wall material has been developed, in which the matrix is a fine-grained cement-sand solution, and the reinforcing filler (fine and coarse) is crushed waste of coarse nonglazed ceramics. Good decorative outlook is imparted to the brick by the finely pulverized, environmentally safe, and readily available complex additive.

The concrete ceramic brick is recommended instead of wall or facing ceramic bricks, since in all parameters (except for heat resistance) it is not inferior to ceramic brick, and its bending strength is 1.5 – 2 times higher. The production cost of the proposed brick is lower that that of its ceramic analogs.

No certification of a new standard is required for the composition of the new wall brick, since its properties meet the requirements of GOST 530–95, and its bending strength parameters are higher.

Technology regulations for the production of concrete ceramic brick are now being developed, and customers for the implementation of this technology are invited.